

CLAIMS:

1. A fuel pump comprising:
 - a pump housing comprising an inlet, a first pumping chamber in flow communication with said inlet, a second pumping chamber in flow communication with said first pumping chamber, and an outlet in flow communication with said second pumping chamber;
 - a first nozzle comprising a check valve extending from at least one of said inlet and said outlet; and
 - a valve intermediate said first pumping chamber and said second pumping chamber.
2. A fuel pump in accordance with Claim 1 further comprising a first diaphragm in said first pumping chamber.
3. A fuel pump in accordance with Claim 2 wherein said pump housing further comprises a first nozzle comprising an air passage extending therethrough, said air passage in flow communication with said first diaphragm.
4. A fuel pump in accordance with Claim 1 further comprising a second diaphragm in said second pumping chamber.
5. A fuel pump in accordance with Claim 4 wherein said pump housing further comprises a second nozzle comprising an air passage extending therethrough, said air passage in flow communication with said second diaphragm.
6. A fuel pump in accordance with Claim 4 further comprising at least one pump inlet cover enclosing one of said first and second diaphragms, and at least one bias member engaging and extending between said one of said first and second diaphragms and said pump inlet cover.
7. A fuel pump in accordance with Claim 1 further comprising a second check valve located in the other of said inlet and said outlet.

8. A fuel pump in accordance with Claim 1 further comprising a second nozzle extending from the other of said housing inlet and said housing outlet.

9. A fuel pump in accordance with Claim 8 further comprising a second check valve in said second nozzle.

10. A fuel pump comprising:
a pump housing comprising an inlet, a first pumping chamber in flow communication with said inlet, a second pumping chamber in flow communication with said first pumping chamber, and an outlet in flow-communication with said second pumping chamber;
a first pump inlet cover secured to said pump housing and covering said first pumping chamber;
a second pump inlet cover secured to said pump housing and covering said second pumping chamber;
a first diaphragm in at least one of said first and second pumping chambers;
and
a bias member extending between one of said first and second pump inlet covers and said diaphragm.

11. A fuel pump in accordance with Claim 10 wherein said first pump inlet cover comprises a first nozzle and an air passage extending through said nozzle.

12. A fuel pump in accordance with Claim 10 wherein said second pump inlet cover comprises a second nozzle and an air passage extending through said nozzle.

13. A fuel pump in accordance with Claim 10 comprising a valve intermediate said first pumping chamber and said second pumping chamber.

14. A fuel pump in accordance with Claim 10 further comprising a second diaphragm in the other of said first and second pumping chambers.

15. A fuel pump in accordance with Claim 14 wherein said first pump inlet cover comprises a first nozzle and an air passage extending through said first nozzle, said air passage in flow communication with said first diaphragm.

16. A fuel pump in accordance with Claim 14 further comprising a second bias member extending between said second diaphragm and said pump housing.

17. A fuel pump in accordance with Claim 16 wherein said second pump inlet cover comprises a second nozzle and an air passage extending through said second nozzle, said air passage in flow communication with said second diaphragm.

18. A fuel pump in accordance with Claim 10 comprising a first check valve located in said inlet.

19. A fuel pump in accordance with Claim 10 comprising a second check valve located in said outlet.

20. A fuel pump in accordance with Claim 10 comprising an inlet nozzle extending from said housing inlet, and an outlet nozzle extending from said housing outlet.

21. A fuel pump in accordance with Claim 20 comprising a first check valve in said inlet nozzle and a second check valve in said outlet nozzle.

22. A fluid actuated fuel pump assembly comprising;
a body defining separate concave inlet and outlet hollows,
a first pulse cover disposed over said inlet hollow,
a first flexible diaphragm sandwiched between said first pulse cover and said body to define a first pulse chamber with said first pulse cover and a first pumping chamber with said inlet hollow,

said body defining a fuel intake passage for admitting fuel into said first pumping chamber as said first diaphragm moves away from and toward said inlet hollow to vary the volume of said first pumping chamber,

a second pulse cover disposed over said outlet hollow,

a second flexible diaphragm sandwiched between said second pulse cover and said body to define a second pumping chamber with said outlet hollow and a second pulse chamber with said second pulse cover,

said body defining a fuel outlet passage for conveying fuel from said second pumping chamber as said second diaphragm moves away from and toward said outlet hollow to vary the volume of said second pumping chamber,

said first pulse cover including a first pressure inlet communicating with said first pulse chamber and adapted for connection to a first source of regularly cycling pressure pulses to move said first diaphragm,

said second pulse cover including a second pressure inlet communicating with said second pulse chamber and adapted for connection to a source of regularly cycling pressure pulses to move said second diaphragm,

a fuel transfer valve through which fuel is pumped from said first pumping chamber to said second pumping chamber in response to said first diaphragm being moved toward said inlet hollow, including first biasing means for biasing said first diaphragm in a direction away from said inlet hollow, and second biasing means for biasing said second diaphragm in a direction toward said outlet hollow, said first and second biasing means and said transfer valve being axially aligned.

23. A fuel pump assembly as set forth in claim 22 including first biasing means for biasing said first diaphragm in a direction away from said inlet hollow, and second

biasing means for biasing said second diaphragm in a direction toward said outlet hollow, the biasing force of said second biasing means being less than the biasing force of said first biasing means, said first and second biasing means and said transfer valve being axially aligned.

24. A fuel pump assembly as set forth in claim 23 wherein said body defines a transfer passage extending between said inlet and outlet hollows and said transfer valve includes a first poppet disposed in said transfer passage.

25. A fuel pump assembly as set forth in claim 24 wherein said transfer passage presents a spring shoulder and said first biasing means consists of a first coil spring seated on said spring shoulder and engaging said first diaphragm.

26. A fuel pump assembly as set forth in claim 25 including a cage seated in said transfer passage and presenting a valve seat, said poppet movably disposed in said cage, said poppet having a valve head for sealing engagement with said valve seat and a stem slidably supported in said cage, a valve spring interacting between said stem and said cage for urging said valve head into sealing engagement with said valve seat.

27. A fuel pump assembly as set forth in claim 26 wherein said transfer passage presents a cage shoulder and said cage presents a cage shoulder seated on said cage shoulder.

28. A fuel pump assembly as set forth in claim 27 wherein said body consists of a plastic material and said cage consists of a metal.

29. A fuel pump assembly as set forth in claim 25 wherein said second pulse cover includes a spring seat and said second biasing means consists of a second coil spring seated on said spring seat and engaging said second diaphragm.

30. A fuel pump assembly as set forth in claim 29 wherein said first and second pulse covers are identical and interchangeable.

31. A fuel pump assembly as set forth in claim 29 wherein said spring seat consists of an annular groove receiving said second coil spring.

32. A fuel pump assembly as set forth in claim 24 wherein each of said covers includes a bead recess facing said body and each of said diaphragms and includes an integral bead disposed in said bead recess of the associated cover.

33. A fuel pump assembly as set forth in claim 32 wherein said second biasing means consists of a second coil spring, a spring retainer plate disposed between each of said first and second springs and each of said diaphragms and, a button axially aligned with said first and second biasing means and said transfer valve and extending from opposite sides of each diaphragm and for engaging the associated pulse cover and for engaging the adjacent retainer plate.

34. A fuel pump assembly as set forth in claim 24 wherein said inlet and outlet passages and said first pressure inlet and said second pressure inlet are all parallel to one another.

35. A fuel pump assembly as set forth in claim 34 including an inlet fitting disposed in said inlet passage and an outlet fitting disposed in said outlet passage, an inlet check valve disposed in said inlet fitting and an outlet check valve disposed in said outlet fitting.

36. A fuel pump assembly as set forth in claim 35 wherein said check valves are identical to one another with said inlet check valve disposed to allow fluid flow only into said first pressure chamber and with said outlet check valve disposed to allow fluid flow only out of said second pressure chamber.

37. A fuel pump assembly as set forth in claim 36 wherein said body consists of a plastic material and said fittings and consist of a metal.

38. A fuel pump assembly as set forth in claim 35 wherein each of said fittings and includes a large supporting portion supported by said body and a tubular portion extending therefrom for connection to a fluid line.

39. A fluid actuated fuel pump assembly comprising;
a body defining a spherical concave inlet hollow facing in one direction and a spherical concave outlet hollow facing in the opposite direction,
a first pulse cover in seating engagement with said body about said inlet hollow and presenting spherical concave inlet depression over said inlet hollow,
a first flexible diaphragm sandwiched between said first pulse cover and said body to define a first pulse chamber with said inlet depression of said inlet pulse cover and a first pumping chamber with said inlet hollow,

body defining a fuel intake passage for admitting fuel into said first pumping chamber as said first diaphragm moves away from and toward said inlet hollow to vary the volume of said first pumping chamber,

a second pulse cover in seating engagement with said body about said outlet hollow and presenting a spherical outlet depression over said outlet hollow,

a second flexible diaphragm sandwiched between said second pulse cover and said body to define a second pumping chamber with said outlet hollow and a second pulse chamber with said outlet depression of said second pulse cover,

said body defining a fuel outlet passage for conveying fuel from said second pumping chamber as said second diaphragm moves away from and toward said outlet hollow to vary the volume of said second pumping chamber,

said first pulse cover including a first pressure inlet communicating with said first pulse chamber and adapted for connection to a first source of regularly cycling pressure pulses to move said first diaphragm,

said second pulse cover including a second pressure inlet communicating with said second pulse chamber and adapted for connection to a source of regularly cycling pressure pulses to move said second diaphragm,

a transfer passage extending between said inlet and outlet hollows, and a first poppet valve disposed in said transfer passage for allowing fuel flow from said first pumping chamber to said second pumping chamber in response to said first diaphragm being moved toward said bottom of said inlet hollow,

said inlet and outlet passages and said first pressure inlet and said second pressure inlet are all parallel to one another and transverse to said transfer passage, said inlet and outlet passages extending in opposite directions, and said first pressure inlet and said second pressure inlet extend in opposite directions.

40. A fuel pump assembly as set forth in claim 39 including an inlet fitting disposed in said inlet passage and an outlet fitting disposed in said outlet passage, an inlet check valve disposed in said inlet fitting for allowing flow only into said first pressure chamber and an outlet check valve disposed in said outlet fitting for allowing only flow out of said second pressure chamber, each of said fittings and including a large supporting portion supported by said body and a tubular portion extending therefrom for connection to a fluid line.

41. A fluid actuated fuel pump assembly comprising;

- a first flexible diaphragm defining a first pulse chamber and a first pumping chamber,
- a fuel intake passage for admitting fuel into said first pumping chamber as said first diaphragm moves to vary the volume of said first pumping chamber,
- a second flexible diaphragm parallel to said first diaphragm and defining a second pumping chamber and a second pulse chamber,
- a fuel outlet passage for conveying fuel from said second pumping chamber as said second diaphragm moves to vary the volume of said second pumping chamber,
- first pressure inlet communicating with said first pulse chamber and adapted for connection to a first source of regularly cycling pressure pulses to move said first diaphragm,
- a fuel transfer valve through which fuel is pumped from said first pumping chamber to said second pumping chamber in response to said first diaphragm being moved,
- said assembly characterized by said transfer valve being disposed between and in alignment with the center of said pressure chambers.